In the Claims:

Please amend the claims as follows:

1. (Currently Amended) A method for noninvasive determination of magnetic susceptibility variation in a patient by measuring magnetic susceptibilities of selected tissue of the patient, the method comprising:

providing an instrument which includes at least one magnetic sensor, an applied field coil and a current source connected to the applied field coil and means for processing sensed signals from the at least one magnetic sensor;

positioning on the patient a flexible bag substantially filled with deformable material having a magnetic susceptibility substantially similar to that of body tissue, said bag being attached to a substantially rigid barrier, the barrier being spaced a predetermined distance from the patient by the ~~liquid~~ material-filled bag, which predetermined distance remains substantially constant during a measuring sequence, the amount of deformable material in the flexible bag remaining constant during a measuring sequence, the instrument being moved with respect to the barrier during the measuring sequence;

positioning the instrument external to the patient in proximity to the tissue of interest and adjacent the barrier;

supplying the applied field coil with current thereby applying a magnetic field to the tissue of interest;

sensing a response from the tissue of interest with the instrument; and

outputting data corresponding to the magnetic susceptibility variation in the tissue.

2. (Original) The method recited in claim 1, wherein an alternating current is supplied to the applied field coil.

3. (Original) The method recited in claim 1, wherein the method further comprises providing the instrument with displacement means for displacing the magnetic sensor and the applied field coil simultaneously thereby compensating for noise introduced to the sensed signals.

4. (Original) The method recited in claim 3, wherein the displacement means operates between about one to six inches.

5. (Original) The method recited in claim 3, wherein the displacement means operates between about 0.5 to 10.0 hertz.

6. (Original) The method recited in claim 1, wherein the outputting of data corresponding to the magnetic susceptibility variation in the human body comprises concentrations of paramagnetic material in the tissue of interest.

7. (Original) The method recited in claim 6, wherein the paramagnetic material is iron and the tissue of interest is a liver.

8. (Original) The method recited in claim 7, wherein the outputting of data corresponds to concentrations of iron in the liver and the resolution of the measurements corresponds to about 30 micrograms per milliliter.

9. (Original) The method recited in claim 1, wherein the positioning step functionally replaces the irregular or variable shape of the patient's body with a volume of material similar in magnetic susceptibility to body tissue, whose surface has a constant shape defined by the rigid barrier;

10. (Currently Amended) An apparatus for noninvasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body, the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field;

a current signal generating source which connects to said applied field coil; and

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in body tissue;

a non-conductive, non-magnetic, substantially rigid barrier;

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and occupying most of the volume within said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container

being shaped and configured to fill in substantially all gaps between said barrier and the patient's body, said barrier being substantially stationary with respect to the patient and the amount of deformable material within said container being constant when magnetic susceptibility variations in the patient's body tissue are measured, the patient remains stationary and said detector assembly moves with respect to said barrier when the measurements are being made; and

means for outputting data from said detector assembly corresponding to a compositional state in the body tissue.

11. (Original) The apparatus recited in claim 10, wherein the current signal generating source provides alternating current (AC).

12. (Original) The apparatus recited in claim 10, wherein the means for processing signals from the at least one magnetic sensor comprises a processor for analyzing the signals obtained from the magnetic sensor.

13. (Original) The apparatus recited in claim 10, wherein the means for processing signals further comprises outputting means for displaying paramagnetic material concentration.

14. (Original) The apparatus recited in claim 13, wherein the paramagnetic material is iron.

15. (Original) The apparatus recited in claim 10, wherein the applied field coil is designed to create a first zone of a finite magnetic field within a selected region of the body, and a second zone of substantially zero magnetic field outside the selected region; and

said at least one magnetic sensor is positioned within said second zone of substantially zero magnetic field.

16. (Original) The apparatus recited in claim 10, wherein said at least one magnetic sensor attaches to a central region relative to the applied field coil.

17. (Original) The apparatus recited in claim 10, wherein said at least one magnetic sensor attaches to a central region relative to said applied field coil and said applied field coil is attached to a planar substrate.

18. (Original) The apparatus recited in claim 15, wherein said applied field coil comprises two parallel flat coils and a connecting circuit between said two parallel coils causing current to flow in identical directions at corresponding locations in said two flat coils, thereby simulating parallel uniform sheets of current.

19. (Currently Amended) The apparatus recited in claim 15, wherein said ~~excitation~~ applied field coil comprises at least two concentric coils and a connecting circuit between said at least two concentric coils causing current to flow in opposite directions, thereby canceling the

4 effects of a magnetic field caused by current flowing through said applied field coil at a central region of said at least two concentric coils.

20. (Original) The apparatus recited in claim 15, wherein said detector assembly
2 is multiple stacked applied field coils.

21. (Original) The apparatus recited in claim 10, wherein said at least one
2 magnetic sensor is a magnetoresistive sensor.

22. (Original) The apparatus recited in claim 10, wherein said at least one
2 magnetic sensor is a fluxgate sensor.

23. (Original) The apparatus recited in claim 10, wherein said at least one
2 magnetic sensor is a magnetoinductive sensor.

24. (Original) The apparatus recited in claim 21, wherein said at least one
2 magnetoresistive sensor is part of a Wheatstone bridge sensing circuit.

25. (Original) The apparatus recited in claim 24, and further including magnetic
2 sensor compensating electronics and a feedback coil disposed about said magnetoresistive sensor for locking an optimum operating point by applying a compensating electrical current from

compensating electronics to said feedback coil thereby maintaining constant measurement sensitivity of the apparatus.

26. (Original) The apparatus recited in claim 10, wherein said detector assembly further comprises a means for oscillating said detector assembly.

27. (Original) The apparatus recited in claim 26, wherein said detector assembly is housed in a housing structure for positioning said detector assembly in proximity to a surface of the human body, and said means for oscillating said detector assembly comprises a motor with attached drive members that move said detector assembly.

28. (Original) The apparatus recited in claim 19, wherein the larger of said concentric coils has a diameter ranging between about 15 to about 50 centimeters.

29. (Original) The apparatus recited in claim 19, wherein there are at least three concentric coils, the outermost coils include at least two coils which are alternatively switched with the current source, whereby sufficient information can be derived independently as to the susceptibility of a deep lying tissue area in the body compared to a corresponding surface tissue area.

30. (Original) The apparatus recited in claim 29, wherein the deep lying tissue area is the liver and the overlying surface tissue area is abdominal tissue.

31. (Original) The apparatus recited in claim 10, wherein said detector assembly comprises an applied field coil on a cylindrical coilform and sensor coils axially spaced from said field coil on either side thereof.

32. (Original) The apparatus recited in claim 31, wherein said sensor coils are oppositely around in a gradiometer configuration.

33. (Original) The apparatus recited in claim 31, wherein said coilform is formed of non-magnetic, non-metallic material.

34. (Original) The apparatus recited in claim 10, wherein said deformable material is water.

35. (Original) The apparatus recited in claim 10, wherein said deformable material is a gel.

36. (Original) A magnetic susceptibility detector device comprising:

an applied field coil configured to connect to a current source, said field coil being configured to create a first zone of a finite magnetic field within a selected region of an observed specimen, and a second zone of substantially zero magnetic field outside said selected region, said applied field coil having at least two concentric electric current carrying coils of conductor material;

a sensing device comprising at least one magnetic sensor, said at least one sensor being positioned within said second zone of substantially zero magnetic field;

a non-conductive, non-magnetic, substantially rigid barrier; and

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and substantially filling said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container being shaped and configured to fill in substantially all gaps between said barrier and the patient's body.

37. (Original) The device recited in claim 36, wherein said at least one magnetic sensor is a magnetoresistive sensor.

38. (Original) The device recited in claim 36, wherein said at least one magnetic sensor is a fluxgate sensor.

39. (Original) The device recited in claim 36, wherein said at least one magnetic sensor is a magnetoinductive sensor.

40. (Original) The device recited in claim 36, wherein said sensing device comprises an applied field coil on a cylindrical coilform and sensor coils axially spaced from said field coil on either side thereof.

41. (Original) The apparatus recited in claim 40, wherein said sensor coils are oppositely around in a gradiometer configuration.

42. (Original) The apparatus recited in claim 40, wherein said coilform is formed of non-magnetic, non-metallic material.

43. (Original) The apparatus recited in claim 36, wherein said deformable material is water.

44. (Original) The apparatus recited in claim 36, wherein said deformable material is a gel.

45. (Currently Amended) An apparatus for noninvasively determining magnetic susceptibility ~~variation~~ variations in body tissue, the apparatus comprising:

a detector assembly comprising:

at least one magnetic sensor and an applied field coil for generating a magnetic field wherein the applied field coil is designed to create a first zone of a finite magnetic field within a selected region of the body, and a second zone of substantially zero magnetic field outside the selected region; and

said at least one magnetic sensor is positioned within said second zone of substantially zero magnetic field;

~~said detector assembly is attached to a~~ means for oscillating said detector assembly;

a current signal generating source which connects to the applied field coil;

a non-conductive, non-magnetic, substantially rigid barrier;

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and substantially filling said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container being shaped and configured to fill in substantially all gaps between said barrier and the patient's body; and

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variation in the body.

46. (Original) The apparatus recited in claim 45, wherein said magnetic sensor attaches to a central region relative to said applied field coil.

47. (Original) The apparatus recited in claim 45, wherein said applied field coil comprises two parallel flat coils and a connecting circuit between said two parallel coils causing current to flow in identical directions at corresponding locations in said two flat coils, thereby simulating parallel uniform sheets of current.

48. (Original) The apparatus recited in claim 45, wherein said excitation field coil comprises at least two concentric coils and a connecting circuit between said at least two concentric coils causing current to flow in opposite directions, thereby canceling the effects of a magnetic field

caused by current flowing through said applied field coil at a central region of said at least two concentric coils.

49. (Original) The apparatus recited in claim 45, wherein said detector assembly is multiple stacked applied field coils.

50. (Original) The apparatus recited in claim 45, wherein said at least one magnetic sensor is a magnetoresistive sensor, said sensor forms part of a Wheatstone bridge circuit and further comprises a means for compensating said magnetic sensor for locking an optimal operational state by applying a compensating electrical current from said compensating means thereby maintaining sensitivity of the apparatus.

51. (Original) The apparatus recited in claim 45, wherein said at least one magnetic sensor is a fluxgate sensor.

52. (Original) The apparatus recited in claim 45, wherein said at least one magnetic sensor is a magnetoinductive sensor.

53. (Original) The apparatus recited in claim 45, wherein said applied field coil comprises a coil on a cylindrical coilform and said at least one magnetic sensor comprises sensor coils axially spaced from said field coil on either side thereof on said coilform.

54. (Original) The apparatus recited in claim 53, wherein said sensor coils are oppositely around in a gradiometer configuration.

55. (Original) The apparatus recited in claim 53, wherein said coilform is formed of non-magnetic, non-metallic material.

56. (Original) The apparatus recited in claim 45, wherein said deformable material is water.

57. (Original) The apparatus recited in claim 45, wherein said deformable material is a gel.

58. (Currently Amended) Apparatus to eliminate background tissue response ~~is~~ in an instrument for non-invasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body, said apparatus comprising:

a non-conductive, non-magnetic, substantially rigid barrier; and

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and occupying most of the volume within said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container being shaped and configured to fill in substantially all gaps between said barrier and the patient's body, said barrier and flexible membrane being configured to be substantially stationary with respect to the patient, and the amount of deformable material within said container remains constant when magnetic susceptibility variations in the patient's body tissue are being measured.

59. (Original) The apparatus recited in claim 58, wherein said deformable material is water.

60. (Original) The apparatus recited in claim 58, wherein said deformable material is a gel.

61. (Currently Amended) An apparatus for noninvasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body,

the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field, said applied field coil comprising at least two concentric circular spiral coils; and

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in body tissue;

a non-conductive, non-magnetic, substantially rigid barrier;

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and occupying most of the volume within said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container also being deformable to fill in substantially all gaps between said barrier and the patient's body, said barrier being substantially stationary with respect to the patient and the amount of deformable material within said container being constant when magnetic susceptibility variations in the patient's body tissue are measured, the patient remains stationary and said detector assembly moves with respect to said barrier when the measurements are being made; and

means for outputting data from said detector assembly corresponding to a compositional state in the body tissue;

wherein the at least two concentric spiral coils have diameters and numbers of turns chosen so that the magnetic field due to an inner concentric spiral coil cancels the magnetic field due to an outer concentric spiral coil in a region near the common center of the least two concentric coils, thereby producing a zone of substantially zero magnetic field, and wherein the at least one magnetic

24 sensor is placed in said zone of substantially zero magnetic field.

62. (Original) The apparatus recited in claim 61, wherein the apparatus further
2 comprises displacement means for displacing the at least one magnetic sensor and the applied field coil simultaneously, thereby compensating for noise introduced to the sensed signals.

63. (Original) The apparatus recited in claim 62, wherein the displacement means
2 operates between about one to about six inches.

64. (Original) The apparatus recited in claim 62, wherein the displacement means
2 operates at between about 0.5 to about 10.0 Hertz.

65. (Original) The apparatus recited in claim 61, wherein the instrument further
2 comprises an electrostatic shield located between the sensor and the sample to be measured.

66. (Original) The apparatus recited in claim 65, wherein the electrostatic shield is
2 octagonal in shape.

67. (Original) The apparatus recited in claim 65, wherein the electrostatic shield
2 comprises conducting material arranged in the form of thin strips connected in a branching pattern.

68. (Original) The apparatus recited in claim 67, wherein the strips are about 0.01 inches in width.

69. (Original) The apparatus recited in claim 68, wherein there is a gap of about 0.01 inches between each strip.

70. (Original) An apparatus for noninvasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body, the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field;

an alternating current signal generating source which connects to said applied field coil;

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in body tissues; and

an electrostatic shield positioned between said at least one magnetic sensor and the sample to be measured;

a non-conductive, non-magnetic, substantially rigid barrier;

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and occupying most of the volume within said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container

also being deformable to fill in substantially all gaps between said barrier and the patient's body; and

means for outputting data from said detector assembly corresponding to a compositional state in the body.

71. (Original) The apparatus recited in claim 70, wherein said sensor comprises a sensing coil, said sensing coil comprising a relatively tightly wound and compact spool of wire.

72. (Original) The apparatus of claim 70, wherein said applied field coil comprises at least two concentric circular spiral coils.

73. (Original) The apparatus of claim 70, wherein the electrostatic shield comprises sheets of conductive material wrapped to provide continuous shielding of electrical fields, wherein overlapping layers of the wrapped material are insulated to prevent electrical contact therebetween.

74. (Original) The apparatus of claim 70, wherein the electrostatic shield comprises thin strips of conductive material, electrically connected in a branching configuration so that all parts of the shield are electrically connected but such that there are no conducting loops enclosing large areas.

75. (Original) The apparatus of claim 74, wherein the strips are less than about 0.015 inches in width.

76. (Original) The apparatus of claim 75, wherein the conductive strips are arranged on a thin substrate.

77. (Original) The apparatus of claim 76, wherein the thin substrate comprises a printed circuit board.

78. (Original) The apparatus of claim 77, wherein the conductive strips are placed on opposite sides of the printed circuit board in a staggered relationship so that the strips on one side cover the area where there are gaps between the strips on the other side.

79. (Original) An apparatus for noninvasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body, the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field;

a current signal generating source, which connects to said applied field coil; and

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in body tissue;

a non-conductive, non-magnetic, substantially rigid barrier;

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and occupying most of the volume within said container, said material

having a magnetic susceptibility substantially equivalent to that of the body tissue, said container being shaped and configured to fill in substantially all gaps between said barrier and the patient's body; and

means for outputting data from said detector assembly corresponding to a compositional state in the body;

wherein the at least one magnetic sensor comprises a sensing coil and wherein the applied field coil and the sensing coil are mounted together in a rigid sensor unit, and wherein the instrument is provided with displacement means for displacing the at least one magnetic sensor and the applied field coil simultaneously, thereby compensating for noise introduced to the sensed signals.

80. (Original) The apparatus of claim 79, wherein the applied field coil comprises at least two concentric circular spiral coils wherein the at least two concentric spiral coils have diameters and numbers of turns chosen so that the magnetic field due to an inner concentric spiral coil cancels the magnetic field due to an outer concentric spiral coil in a region near the common center of the at least two concentric coils, thereby producing a region of nearly zero magnetic field and wherein the at least one magnetic sensor is positioned in said region of nearly zero magnetic field.

81. (Original) The apparatus of claim 79, wherein the sensing coil and applied field coil are enclosed in an electrostatic shield.

82. (Original) The apparatus of claim 81, wherein the electrostatic shield comprises sheets of conductive material wrapped to provide continuous shielding of electrical fields, wherein overlapping layers of the wrapped material are insulated to prevent electrical contact therebetween.

83. (Original) The apparatus of claim 81, wherein the electrostatic shield comprises thin strips of conductive material, electrically connected in a branching configuration so that all parts of the shield are electrically connected but such that there are no conducting loops enclosing large areas.

84. (Original) The apparatus of claim 83, wherein the strips are less than about 0.015 inches in width.

85. (Original) The apparatus of claim 84, wherein the conductive strips are arranged on a thin substrate.

86. (Original) The apparatus of claim 85, wherein the thin substrate comprises a printed circuit board.

87. (Original) The apparatus of claim 86, wherein the conductive strips are placed on opposite sides of the printed circuit board in a staggered relationship so that the strips on one side cover the area where there are gaps between the strips on the other side.

88. (Original) An apparatus for noninvasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body, the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field;

a current signal generating source, which connects to said applied field coil; and

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in body tissue;

a non-conductive, non-magnetic, substantially rigid barrier;

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and occupying most of the volume within said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container being shaped and configured to fill in substantially all gaps between said barrier and the patient's body; and

means for outputting data from said detector assembly corresponding to a compositional state in the body;

wherein the at least one magnetic sensor comprises a sensor unit, said sensor unit comprising two sensing coils connected in series, equal in area, but oppositely wound, and oppositely spaced from the applied field coil on a cylindrical coilform in a first-order gradiometer configuration;

wherein the sensing coils and applied field coil have areas and geometric locations chosen so as to cancel out the detected signal due to the applied magnetic field;

wherein the applied field coil and the sensing coils are mounted together in said sensor unit, and wherein the instrument is provided with means for displacing the sensor unit, thereby compensating for the effects of temperature drift; and

wherein the instrument further comprises an electrostatic shield between the sensing coils and the body tissue to be measured.

89. (Original) The apparatus of claim 88, wherein the means for displacing the sensing unit displaces the sensor unit toward and away from the body tissue.

90. (Original) The apparatus of claim 88, wherein the means for displacing the sensing unit displaces the sensor unit laterally with respect to the body tissue.

91. (Original) The apparatus of claim 88, wherein the applied field coil comprises a circular loop, and the sensing coils comprise a first order gradiometer, said gradiometer consisting of two oppositely wound coils of equal area, connected in series and located symmetrically with respect to the applied field coil so as to cancel out the detected signal due to the applied field.

92. (Original) The apparatus of claim 91, wherein the sensing coils are unequal in area, and their locations with respect to the applied field coil are chosen so as to cancel out the detected signal due to the applied field.

93. (Original) The apparatus of claim 88, wherein the applied field coil is a first order or higher gradiometer, and the sensing coils are configured as second order or higher gradiometers.

94. (Currently Amended) A method for noninvasive determination of magnetic susceptibility ~~variation~~ variations in a patient by measuring magnetic susceptibilities of selected body tissue of the patient, the method comprising:

providing an instrument which includes at least one magnetic sensor and an applied field coil;

positioning on the patient a flexible bag substantially filled with deformable material having a magnetic susceptibility substantially similar to that of the body tissue, said bag being attached to a substantially rigid barrier, the barrier being spaced from the patient by the deformable material filled bag;

positioning the instrument external to the patient in proximity to the tissue of interest and adjacent the barrier;

supplying the applied field coil with current thereby applying a magnetic field to the tissue of interest;

scanning the at least one magnetic sensor along the rigid barrier to generate a map of susceptibility variations of the underlying body tissues; and

outputting data corresponding to the magnetic susceptibility ~~variation~~ variations in the tissue.

95. (Currently Amended) A method for noninvasive determination of magnetic susceptibility variation in a patient by measuring magnetic susceptibilities of selected body tissue of the patient, the method comprising:

providing an instrument which includes at least one magnetic sensor and an applied field coil;

positioning on the patient a flexible bag substantially filled with a first amount of deformable material having a magnetic susceptibility substantially similar to that of the body tissue, said bag being attached to a substantially rigid barrier to form a container having a first volume, the barrier being spaced a first predetermined distance from the patient by the deformable material filled bag;

positioning the instrument external to the patient in proximity to the tissue of interest and adjacent the barrier;

~~providing the instrument with displacement means for a displacement of the magnetic sensor and the applied field coil simultaneously, thereby compensating for noise that may be introduced to the sensed signals;~~

supplying the applied field coil with current thereby applying a magnetic field to the tissue of interest;

periodically displacing the instrument with respect to the barrier;

sensing a response from the tissue of interest with the instrument;

outputting data corresponding to the magnetic susceptibility variation in the tissue; then

~~providing~~ moving the instrument and the substantially rigid barrier ~~with means for withdrawing the magnetic field coil and applied field coil~~ simultaneously with respect to ~~from~~ the

patient, the barrier being thereby spaced from the patient by a second predetermined distance and changing the container to have a second volume, the second volume being filled with a second amount of deformable material;

repeating the supplying step, the periodically displacing step, the sensing step and outputting step; and

subtracting the susceptibility measurement observed after the moving ~~withdrawing~~ step from the susceptibility measurement observed before the moving ~~withdrawing~~ step.

96. (Original) The method according to claim 95, wherein said displacement is between about one to about six inches.

97. (Original) The method according to claim 95, wherein the displacement means operates between about 0.5 to about 10.0 Hertz.

98. (Currently Amended) The method according to claim 95, wherein the moving step ~~said withdrawal~~ permits the drift in the sensor output to be subtracted out more effectively.

99. (Currently Amended) The method according to claim 95, wherein said displacement and moving ~~withdrawal~~ occur simultaneously.

100. (Currently Amended) An apparatus for noninvasively measuring magnetic

susceptibility variations in the body tissue of a patient to determine a compositional state in the body, the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field;

a signal refinement means adjustably positioned with respect to the sensor;

a current signal generating source which connects to said applied field coil; and

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in body tissue;

a non-conductive, non-magnetic, substantially rigid barrier;

a flexible membrane sealed to said barrier to form a container therewith, there being a deformable material within and occupying most of the volume within said container, said material having a magnetic susceptibility substantially equivalent to that of the body tissue, said container being shaped and configured to fill in substantially all gaps between said barrier and the patient's body; and

means for outputting data from said detector assembly corresponding to a compositional state in the body tissue;

wherein said applied field coil is designed to produce a region of nearly zero magnetic field and said sensor is positioned in said region of nearly zero magnetic field and wherein adjustment of said signal refinement means improves cancellation of the applied field at the sensor location.

101. (Currently Amended) The ~~method~~ apparatus of claim 100, wherein said signal

refinement means is selected from the group consisting of a balance coil, ferromagnetic tabs on the coilform and an electronic imbalance sensing and compensating means.

102. (Currently Amended) The ~~method~~ apparatus of claim 101, wherein said balance coil is connected in series with the applied field coil.

103. (Currently Amended) The ~~method~~ apparatus of claim 101, wherein said balance coil is adjustable on an axis parallel to a longitudinal axis of the sensor.

104. (Currently Amended) The ~~method~~ apparatus of claim 101, wherein the balance coil comprises a plurality of turns of wire on a non-metallic, non-magnetic cylindrical coilform.

105. (Currently Amended) The ~~method~~ apparatus of claim 104, wherein the plurality of turns of wire is about 10 to about 20 and the cylindrical coilform diameter is about 1 to about 1.5 inches.

106. (Original) An apparatus for noninvasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body, the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field;

an alternating current signal generating source, which connects to said applied field coil;

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in body tissues; and

an electrostatic shield positioned between said at least one magnetic sensor and the sample to be measured; and

means for outputting data from said detector assembly corresponding to a compositional state in the body.

107. (Original) The apparatus recited in claim 106, wherein said sensor comprises a sensing coil, said sensing coil comprising a relatively tightly wound and compact spool of wire.

108. (Original) The apparatus of claim 106, wherein said applied field coil comprises at least two concentric circular spiral coils.

109. (Original) The apparatus of claim 106, wherein the electrostatic shield comprises sheets of conductive material wrapped to provide continuous shielding of electrical fields, wherein overlapping layers of the wrapped material are insulated to prevent electrical contact therebetween.

110. (Original) The apparatus of claim 106, wherein the electrostatic shield comprises thin strips of conductive material, electrically connected in a branching configuration so that all parts of the shield are electrically connected but such that there are no conducting loops enclosing large areas.

111. (Original) The apparatus of claim 110, wherein the strips are less than about 0.015 inches in width.

112. (Original) The apparatus of claim 111, wherein the conductive strips are arranged on a thin substrate.

113. (Original) The apparatus of claim 112, wherein the thin substrate comprises a printed circuit board.

114. (Original) The apparatus of claim 113, wherein the conductive strips are placed on opposite sides of the printed circuit board in a staggered relationship so that the strips on one side cover the area where there are gaps between the strips on the other side.

115. (Currently Amended) An apparatus for noninvasively measuring magnetic susceptibility variations in the body tissue of a patient to determine a compositional state in the body, the apparatus comprising:

a detector assembly that includes:

at least one magnetic sensor and an applied field coil for generating a magnetic field;

a current signal generating source, which connects to said applied field coil; and

means for processing signals from said at least one magnetic sensor of observed magnetic susceptibility variations in the body tissue; and

means for outputting data from said detector assembly corresponding to a compositional state in the body tissue;

wherein the at least one magnetic sensor comprises a sensor unit, said sensor unit comprising two sensing coils connected in series, equal in area, but oppositely wound, and oppositely spaced from the applied field coil on a cylindrical coilform in a first-order gradiometer configuration;

wherein the sensing coils and applied field coil have areas and geometric locations chosen so as to cancel out the detected signal due to the applied magnetic field;

wherein the applied field coil and the sensing coils are mounted together in said sensor unit, and wherein the instrument is provided with means for displacing the sensor unit, thereby compensating for the effects of temperature drift; and

wherein the instrument further comprises an electrostatic shield between the sensing coils and the body tissue to be measured.

116. (Original) The apparatus of claim 115, wherein the means for displacing the sensing unit displaces the sensor unit toward and away from the body tissue.

117. (Original) The apparatus of claim 115, wherein the means for displacing the sensing unit displaces the sensor unit laterally with respect to the body tissue.

118. (Original) The apparatus of claim 115, wherein the applied field coil comprises a circular loop, and the sensing coils comprise a first order gradiometer, said gradiometer consisting of two oppositely wound coils of equal area, connected in series and located symmetrically with respect to the applied field coil so as to cancel out the detected signal due to the applied field.-